The Effect of Entrepreneurial Firm Diversity on Firm Survival

An Analysis of Start-Ups in Technology Based and Knowledge Intensive Industries

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An Analysis of Start-Ups in Technology Based and Knowledge Intensive Industries

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Introduction

In the last couple of decades, many studies have been conducted on the effect a diverse composition of teams have on their performance (see e.g. Williams and O'Reilly (1998); Horwitz (2005) for review). A large contribution within this field has been made by researchers focusing on teams in organizational settings, e.g. top management and product development teams (Murray, 1989; Bantel and Jackson, 1989; Wiersema and Bantel, 1992; Ancona and Caldwell, 1992; Jackson et al., 1995; Pelled, 1996; Watson et al., 2002; Dwyer et al., 2003; Dahlin et al., 2005). The number of studies focusing on the diversity in entrepreneurial ventures are scarce (Lyon et al., 2000; Ruef et al., 2003; Chowdhury, 2005; Foo et al., 2005), which is surprising given the general perception of entrepreneurship as a collective phenomenon (Schoonhoven and Romanelli, 2001). The interest for diversity in entrepreneurial is fueled from two sides. First, team diversity researchers suggest that diversity would lead to positive effects in turbulent environment (Pitcher and Smith, 2001), an environment to which many entrepreneurial ventures are exposed to . Second, there is an implicit interest in diversity, and its counterpart uniformity, in explaining entrepreneurial performance. As a result of treating entrepreneurship as a collective activity there are two requirements for entrepreneurial success that receive attention, i.e. cohesiveness of the team (Beckman, 2006; Beckman et al., 2007) and the access to a heterogeneous knowl-

edge base to solve complex problems and enhance creativity (Chowdhury, 2005). There seems to be some degree of contradiction since cohesion would require a common understanding, which is reached through a high degree of homogeneity for instance in past employer affiliation, while a more heterogeneous knowledge base is obtained via a higher degree of heterogeneity.

This paper follows the existing work on diversity by looking at two established categories of demographic diversity, i.e. ascribed and achieved characteristics, and extend it in two distinct ways. First, I want to contribute to the discussion of diversity in new ventures, not only by looking at whether new ventures are diverse in their composition (Ruef et al., 2003), but also to look at the impact of diversity on crucial performance measure, in this case firm survival. Second, I will look beyond the initial composition of the firm and apply a longitudinal perspective by looking at employee diversity over a longer period of time and analyze the effect diversity has on firm survival for any given year. The structure of the database I use allows me to look at the firm dynamics of a fixed sample of new established firms.

The database used is known as the Danish Integrated Database for Labour Market Research (IDA). From this database I select a sample of new knowledge-intensive and technology based firms in high tech and medium high tech arieas in Denmark in the period 1997-2000 and examine whether these firms are able to survive in the following years. IDA is a longitudinal linked employer-employee dataset with information on individuals regarding their ascribed and achieved characteristics. It is possible to identify the diversity of employment in the 3,956 newly established firms in this four year period. The results of the analyses shows, at this stage, no significant effect of diversity on survival. According to the theory this is expected when focusing on the ascribed characteristics, e.g. age, gender, and nationality, but surprising for the achieved characteristics, e.g. work experience and education.

After this introduction, the paper will continue with the theoretical framework focussing on definitions of diversity and the link is between diversity and team performance. Afterwards, the method will be discussed describing the database, the sample, and the construction of the variables used in the logistic regression analyses. Section 4 will present the descriptive statistics and the results of the regression analysis and the paper will end up with a discussion and some concluding remarks.

Theory and Hypotheses

The long history of diversity studies has also resulted in many different definitions of diversity (Williams and O'Reilly, 1998; Harrison and Sin, 2006). The database that I use for the analysis can identify the composition of a firm over time. For this reason, I treat diversity as the collective amount of difference between members within a social unit (Harrison

and Klein, 2007), looking at the distribution of demographic attributes within a team (Joshi and Jackson, 2003). The diversity of a team is then connected to group processes or performance where the existing studies show very inconsistent results.

Diversity and Team Performance

Reviews on team diversity and performance make a distinction between two competing approaches (Williams and O'Reilly, 1998; Horwitz, 2005; Horwitz and Horwitz, 2007). Those focusing on the negative aspect of diversity refer to the similarity attraction paradigm or social categorization theory. Researchers in favor of the similarity attraction paradigm argue for the interpersonal attraction that arises due to the similarities that exist between members. This attraction is a result of shared experiences and values, which might ease the interaction between team members. This would not be the case for heterogeneous teams (Horwitz, 2005). In the case of social categorization, members place themselves and others into social categories often using demographic attributes (Williams and O'Reilly, 1998). This might lead to in-group and out-group membership in a social setting (Joshi and Jackson, 2003), where members of other groups are regarded as less attractive, trustworthy, honest, cooperative compared to members of the own group. This would eventually lead to conflict in the organization.

Researchers adopting the cognitive resource diversity hypothesis argue that team diversity has a positive impact through the increase in skills, abilities, information and knowledge as a result of diversity (Cox and Blake, 1991; Hambrick et al., 1996; Williams and O'Reilly, 1998; Horwitz, 2005). Social categorization and similarity attraction fail to capture the information that is present in different groups. So, even if teams are diverse in their ascribed characteristics and thus have a higher likelihood of conflict, heterogeneous teams will promote creativity, innovation and problem solving (Horwitz, 2005).

Both theoretical viewpoints provide sound arguments on the effect of diversity on firm performance. Empirical studies are inconsistent between the two. This paper will not subscribe to one theoretical approach on diversity team performance since the impact would be determined by several factors, e.g. type of team, type of performance, type of demographic attribute. This paper already determined the context (i.e. entrepreneurial ventures), and type of performance (i.e. firm survival). Pitcher and Smith (2001) argued that the diverse composition would only matter in turbulent teams, which is a category that would fit an entrepreneurial venture. These firms need to be creative, innovative, and being able to solve complex problems in order to survive (Chowdhury, 2005). This behavior can be facilitated by a diverse team (Horwitz, 2005). In addition, entrepreneurial firms need also some degree of cohesion (Beckman, 2006; Beckman et al., 2007), which is more likely to occur when teams are homogeneous.

The formulation of hypotheses is a challenging task considering the influence of the two above-mentioned forces on the survival of entrepreneurial venture. However, firms can be

diverse on a number of different dimensions and diversity on some dimensions might be positive while others would have a negative effect on firm performance. These possible effects will be discussed from the general perspective and how it will in particular effect entrepreneurial ventures. This will be done by splitting the demographic attributes in two larger categories, i.e. ascribed and achieved characteristics, as it has been done in earlier studies focusing on diversity in firms (Ruef et al., 2003; McPherson et al., 2001).

Ascribed Characteristics

The ascribed characteristics are the relational attributes of team members (Hambrick et al., 1996) and are not necessary for an individual to fulfill a specific task at hand (Joshi and Jackson, 2003; Foo et al., 2005). The demographic attributes in this categories are also referred to as social category diversity (Joshi and Jackson, 2003). This term already suggests that diversity in the ascribed characteristics is regarded as negative. The most studied attributes in this category are gender, age, and cultural background. Differences within these attributes are easily detected (Tsui et al., 1995) and these characteristics can, under normal circumstances, not be changed, which increases the likelihood of emotional conflict (Pelled et al., 1999; Ensley et al., 2002). This has a negative effect on the performance, morale and cohesion of teams because it distracts energy and resources from the task at hand (Williams and O'Reilly, 1998; Foo et al., 2005). Those arguing for the negative aspect of gender diversity state that the different interaction styles between men and women induces a process loss (Horwitz, 2005). A similar argument is valid for age. A low level of age diversity would indicate that the members of the unit are born around the same time period and have developed the same outlook on life and shared experiences (Williams and O'Reilly, 1998). Diversity might lead to conflict since there is a lack of these shared perspectives (Horwitz, 2005). The last attribute is a difference in cultural background, which is often indicated as a difference in ethnicity or nationality. Nationality affects a person both in the way individuals look as in their values, language and cognitive perception (Hambrick et al., 1998). Dahlin et al. (2005) argues that nationality diversity leads to social categorization because nationality has been determined as a superordinate determinant of identity. This increases the forming of groups within organizations and thereby differentiating from other sub groups, which give rise to an increased likelihood of conflict leading to a detrimental effect on performance.

Besides the negative effects of diversity on the ascribed characteristics, there are several studies arguing for a positive effect. These researchers are more interested in the cognitive resource dimension behind earlier-mentioned attributes. More interesting is the observation that many of the specific characteristics that were negative in the social categorization approach are treated positive from a cognitive viewpoint of diversity. Gender is regarded positive due to the different interaction styles of men and woman, because these teams would be moderately effective in tasks that require task activity and those that require social activity (Wood, 1987; Horwitz, 2005). A positive effect of diversity in nationality would build on similar dynamics on different interaction styles (Cox and Blake, 1991; Dahlin

et al., 2005). These different interaction styles would result in an improvement of solving complex problems (Dwyer et al., 2003). There are, however, some restriction connected to the positive effect of diversity on gender and nationality. For gender, there is argued for the need of a well-balanced gender composition (Williams and O'Reilly, 1998; Horwitz, 2005). Watson et al. (1993) found a positive effect of a diverse team based on ethnicity, but they were only able to outcompete homogeneous teams after a longer period. A similar point is made by Dahlin et al. (2005). They argue that moderately diverse teams based on nationality create form sub groups but high diverse teams have not the opportunity to do so and as a result do not experience social categorization. On the effect age diversity on performance, Pelled et al. (1999) found that diversity in age would be beneficial, because there are signs of less emotional conflict. They argue that conflict arises because there is jealousy among people from similar age when comparing career accomplishments. In addition, diverse teams consisting out of a mix of young individuals pursuing aggressive strategies while the seniors can take this new ideas an evaluate them. The combination of these two perspectives could potentially benefit the organization (Horwitz, 2005).

There is not much consistency related to the effects of non-task related diversity in the diversity team literature. The studies on diversity in an entrepreneurship context lean to the negative perspective (Ensley et al., 2002; Foo et al., 2005; Chowdhury, 2005). New ventures operate in turbulent environments and clear differences between individuals might increase the likelihood of emotional conflict. The potential benefits as a result of different perspective might lower the negative effect but it remains a challenging to turn it into a postive effect. Therefore, I argue in line with Chowdhury (2005) for the negative or neutral effect of diversity based on age, gender and nationality. These characteristics enrich the team with diverse perspective but also hamper the firm with emotional conflict. In addition, there is most likely a good reason why most teams are homogeneous on these characteristics (Ruef et al., 2003). Recruitment processes in entrepreneurial ventures already avoid diversity on those characteristics that increase the likelihood of emotional conflict. This leads to the formulation of the following hypothesis:

> *Hypothesis 1: Diversity on the ascribed characteristics has a negative or neutral effect on firm survival.*

Since the ascribed characteristics can be broken down in multiple attributes sub hypotheses for each of the studied attributes are formulated.

> *Hypothesis 1a: Gender diversity has a negative or neutral effect on firm survival.*

> *Hypothesis 1b: Age diversity has a negative or neutral effect on firm survival.*

Hypothesis 1c: Nationality diversity has a negative or neutral effect on firm survival.

Achieved Characteristics

The achieved characteristics are used to measure diversity based on task-related activities. Often used demographic attributes in this dimension are education and work experience. The research predominantly connects positive effects to this type of diversity. This can be explained due to the strong connection with the cognitive diversity perspective. Diversity based on these characteristics would result in a broader or deeper knowledge base is possessed by the members of the team due to different experiences (Foo et al., 2005). Instead of emotional conflict, task conflict will occur due to functional background differences and job-related type of diversity (Pelled et al., 1999). As a result, this type of diversity will lead to informal communication and more task communication, which leads to the discussion of options that reduces groupthink and teams would obtain solutions for complex problems more rapidly and frequently (Zenger and Lawrence, 1989; Foo et al., 2005). Education would be an indicator of the knowledge, skills and capability a person possesses. In addition, it might reflect the cognitive strength of a person (Horwitz, 2005) and a different perspective in the way of doing business (Foo et al., 2005). Within the education dimension there are differences in type (e.g. science, engineer, humanistic, etc.) of education and the level (e.g. ground level, bachelor, master, etc.) of education. Lower levels focus on practical skills and higher levels on conceptual skills (Foo et al., 2005). Diversity based on types and levels of education provides a broader knowledge based. Work experience is another form by which individuals obtain knowledge and skills. The benefits from a diverse composition in work experience would mean that the members have accumulated different type of knowledge and skills through on-the-job training (Joshi and Jackson, 2003).

The differences in education and work experience might also lead to similarity attraction and social categorization. Because members that followed similar educations share a common language they group together, because they either feel superior or because they have difficulty in understanding the language and narratives of those members with another educational background. Even though low levels are more practical and high levels are more conceptual there is also a status dimension in education level. When this perception of status exist, the task conflict might shift to an emotional conflict negatively influencing performance. The same would be valid for the work experience dimension depending on how work experience is measured, e.g. duration vs. type of work experience.

Even though the effect of diversity on the achieved characteristics can move in both directions, I will argue for the benefit of diversity on these attributes opposed to the negative effects for two reasons. First of all extreme, potential negative, cases of diversity will be avoided through recruitment processes. Those recruited will fit into the organization based on their obtained competences. Second, in entrepreneurial firms there is a need for a broad range of problem solving skills, while emotional conflict might still arise there

would be a better problem solving environment when the knowledge base is diverse. In addition, conflict that arises from diversity based on this cognitive dimension is also beneficial for the cohesion in the organization (Ensley et al., 2002). For this reason, I argue for the following achieved characteristic hypothesis.

Hypothesis 2: Diversity on the achieved characteristics has a positive effect on firm survival.

With the following sub hypotheses:

Hypothesis 2a: Education diversity has a positive effect on firm survival.

Hypothesis 2b: Work experience diversity has a positive effect on firm survival.

A Longitudinal Perspective

One element hat needs to be considered is the longitudinal perspective on diversity. Most studies look at diversity in the composition of a team at a certain point in time. However, there is not reason to assume that the diversity in teams and the related effect of this diversity is the same over time. All members of a entrepreneurial venture are by default new to the firm. For this reason the diversity will strike hardest, both positive and negative, during the first years of existence. Later on, those that are already present in the firm become more similar and the team becomes less turbulent. Diversity based on the early members will not have a strong effect anymore since the team has learned to manage the diversity or the lack of diversity by using other sources.

In addition, members might exit and enter a teams, which results in a change of composition and consequently in a possible change of diversity in the team (Arrow and McGrath, 1993). Even if teams stay together for a longer period it is hard to argue that at the end of the period the diversity in the team is similar to the diversity in the beginning of the period due to knowledge transfers and the creation of a shared frame of reference. It is thus the change in the composition of the team that results in a potential change in diversity when teams have been together for a certain time period. A change in composition might have various reasons. Members are added because of resource seeking behavior or to strengthen the manifestation of interpersonal contact, depending on what the members in the new ventures think is needed (Forbes et al., 2006). Current diversity studies implicitly consider member addition as an increase in diversity because they look at diversity in organizational tenure (Pfeffer, 1983; Williams and O'Reilly, 1998; Joshi and Jackson, 2003; Horwitz, 2005). New members have a different history and different work experience compared to those already longer in the firm, thereby increasing diversity. On the other side

members are leaving the organization because there is conflict, the firm is downsizing due to disappointing firm performance, or there are better opportunities somewhere else. This change might thus result in the continuous survival of the firm no matter if there is an increase or decrease in diversity.

To take this longitudinal perspective into account the following hypothesis has been formulated.

> *Hypothesis 3: Effects of diversity are most prominent in the beginning of the entrepreneurial venture*

Beyond the Entrepreneurial Team

Earlier studies on team dynamics within the domain of entrepreneurship, including the few on diversity, have focused on what is called entrepreneurial or founding teams (Eisenhardt and Schoonhoven, 1990; Kamm et al., 1990; Cooper and Daily, 1997; Ensley et al., 2002; Ucbasaran et al., 2003; Ruef et al., 2003; Chowdhury, 2005; Forbes et al., 2006; West, 2007). These studies emerged as a reaction on the argument that the entrepreneur in entrepreneurship is typical plural, not singular (Gartner et al., 1994; Schoonhoven and Romanelli, 2001; Katz et al., 2000). The definition of what an entrepreneurial team is, is ambiguous. When asking start-ups to identify the founding team they respond with, e.g. "Do you mean full-time or part-time founders?", "Do you mean only early founders or do you include later founders?" and academics face the same problem when describing an entrepreneurial team (Cooper and Daily, 1997).

Despite this ambiguity, commonalities regarding the description of an entrepreneurial team is found in the that members of this unit have a certain degree of ownership and/or control in the new venture (Ucbasaran et al., 2003). The question arises if, considering that most firms start small and hardly change in size during their lifetime (Aldrich and Ruef, 2006), the focus on the entrepreneurial team would underestimate the importance of the other employees in the new organization (Cardon and Stevens, 2004). It can be argued that the focus on a small group within an already small organizational setting would negatively effect explanatory power of team diversity, especially when diversity is treated as a compositional construct (Harrison and Klein, 2007). The entrepreneurial team might be considered the heart of the new venture (Cooper and Daily, 1997) but employees, which are most likely recruited to strengthen the organization, are also vital members in the new venture. Even more so when the size of these ventures are limited. This is the reason for looking beyond the founder and founding team and include all the members in the diversity analysis.

Method

Data

To analyze the effect of diversity in the composition of entrepreneurial ventures on their survival, I rely on a comprehensive dataset with information on all firms and the entire active labour market in Denmark from 1980 and onwards. The information is gathered from Danish government registers and is maintained by Statistics Denmark. This database is known under the name Danish Integrated Database for Labor Market Research (from now on referred to by its Danish acronym IDA). IDA is suitable for the analysis as its longitudinal characteristic allows the researcher to follow individuals, plants and firms over time. As a result, firm dynamics (birth, death and growth rate of firms) and the employment history of the active labour force can be identified. The database holds information on both ascribed, e.g. gender, age, nationality; and achieved characteristics, e.g. type and level of education, work experience, occupation of all individuals. Because these individuals can be matched to a firm at any given year, it is possible to measure the diversity based on these characteristics for each firm.

Sample

Using this dataset, I select new start-ups within the so-called technology based and knowledge-intensive industries in the period 1997-2001. I use the plant and firm identification codes to identify new start-ups. The first four digit of the plant identification number indicates the year in which the plant was founded. Consequently, any firm with a plant identification number that starts with a number lower then 1995 will be removed. In order to assure that the firm did not change their plant identification number I checked whether or not the firm identification number existed prior to 1997. If this was the case the firm was removed from the sample. The definition of a start-up in this paper are thus plants with no prior identify number that can be associated with a firm without a prior identify number (Dahl and Reichstein, 2006). The OECD en Eurostat have determined which industries, based on the European NACE classification, can be coined as high-tech, medium-high-tech, and knowledge intensive. Table 1 presents an overview of those NACE codes. Finally, I will use the ownership code to remove those firms that are considered owned by the public sector or have a foreign affiliation at the moment of founding. As a result, the sample will consist out of 3,956 firms.

Diversity Measures

In this paper, employee diversity is defined as the distribution of differences among the members of the firm with respect to a common attribute. Diversity is thus treated as a unit-level compositional construct (Harrison and Klein, 2007). These differences are measured based on three dimensions, i.e. variety, balance and disparity (Stirling, 2001; Harrison and Klein, 2007). Variety relates to the number of categories of a certain attribute that are present in the firm where a high number of categories results in a high level of diversity. Balance is based on the shares of the specific categories where a more equal dis-

Table 1: High- and Medium-High -Technology and Knowledge Intensive Business Services (NACE Revision 1.1)

Industry Name	NACE Classification
High-Technology	
1. Aerospace	35.3
2. Computers, Office Machinery	30
3. Electronics-Communications	32
4. Pharmaceuticals	24.4
5. Scientific Instruments	33
Medium-High-Technology	
6. Motor Vehicles	34
7. Electrical Machinery	31
8. Chemicals	24 - 24.4
9. Other Transport Equipment	35.2 + 35.4 + 35.5
10. Non. Electrical Machinery	29
Knowledge-Intensive High-Technology Services	
11. Post and Telecommunications	64
12. Computer and Related Activities	72
13. Research and Development	73
Knowledge-Intensive Market Services	
14. Water Transport	61
15. Air Transport	62
16. Real Estate Activities	70
17. Renting of Machinery and Equipment	71
18 Other Business Activities	74 -74.7
Knowedge-Intensive Financial Services	
19. Financial intermediations	65
20. Insurance and Pension Funds	66
21. Activities Auxiliary to Financial Intermediation	67

source: Eurostat (2008)

tribution of the categories gives a higher degree of diversity. The last dimension of diversity is disparity. This dimension refers to the distance between the outer boundaries of the categories within one characteristic. (Harrison and Klein, 2007) makes a distinction between separation and disparity where the first relates to horizontal differences, e.g. difference in position, opinion, education, and the latter on vertical differences, e.g. status and pay.

In this analysis two different measures are used. For the categorical variables we use a Shannon-Weaver entropy index to indicate the degree of diversity in the firm. Entropy is defined as:

$$\sum_{i=1}^{n} p_i(\ln \frac{1}{p_i}) = (p_1(\ln \frac{1}{p_1}) + p_2(\ln \frac{1}{p_2}) + \ldots + p_n(\ln \frac{1}{p_n}) \quad (1)$$

This entropy index is a dual concept measure that includes the variety and balance of the categories (Junge, 1994; Stirling, 2001; Harrison and Sin, 2006). However, the entropy index is more sensitive to an increase in variety than an increase in balance (Peet, 1974). Diversity in age is measured by the coefficient of variation to include disparity in age. This measure is often used to calculate diversity for non-negative variables, such as age, tenure and wage (Harrison and Sin, 2006). The coefficient of variation is defined as:

$$CV = \frac{\sigma}{\bar{x}} = \frac{\sqrt{\frac{[\sum(x_i - \bar{x})^2]}{n}}}{\bar{x}} \tag{2}$$

Diversity Variables

The core independent variables are those indicating the degree of diversity in the venture. Each type of diversity has a certain characteristics that will be determine which measure is most appropriate. Which of the above-mentioned diversity measured is used and how these measures are constructed will be briefly explained for each of the different demographic attributes. Some of these demographic attributes will function both as diversity indicator and as control variables.

Gender

Gender diversity, being a straightforward categorical variable, will be measured using the entropy index. Besides this diversity measure, I also will calculate the share of men present in the entrepreneurial venture for each given year to identify the effect of the majority group within the gender classification.

Age

The second ascribed characteristics is age. The diversity in this category will be measured using the coefficient of variation. In addition, the average age of the venture will be calculated to look at the overall age effect on survival. However, even if the composition of the team stays equal over the years the coefficient of variation will change as a result of the increasing average age. In order to identify a change in diversity based on the age characteristic I will calculate the average age of the firm based on the age the individuals have in 1995.

Nationality

Nationality is the last ascribed characteristic. IDA provides nationality on the country level. I grouped the countries based on geographical/cultural/linguistic closeness in order to lower the number of categories. The categories created are: Danes, Western European & Anglo Saxon, Eastern European, Southern European & Latin America, African and Asian. An entropy measure calculates the diversity based on this categorization. Two additional remarks need to be made on this variable. The majority of the population falls in the first

category (91.3 percent of which the majority Danes fall in this category in the first year of existence) and the fact that a person can obtain a new nationality will ultimately result that nationality is not a 100 percent accurate measure for cultural background.

Education

Education is divided in two parts as has been done by Foo et al. (2005). First there has been made a categorization based on the type of education background the members of the organization has making a distinction between: Basic, Humanistic & Arts, Administration & Social Sciences, Agriculture & Food, Health, Transport, Defence & Police and Technical & Science. The entropy index will be used to calculate the diversity based on these characteristics. The second diversity measure of education will focus on diversity in education level making a distinction between: no vocational training, vocational training, short further education, medium long further education, and long further education. These education levels have been transformed to a continuous scale making it possible to calculate diversity using the coefficient of variation. Based on this continuous scale, an average education level will be calculated as a control variable.

Work Experience

The last demographic attribute is work experience. Most studies use a diversity measure based on tenure in the current organization arguing that those entering the organization at a later point in time are different compared to those already present (Pfeffer, 1983; Williams and O'Reilly, 1998; Joshi and Jackson, 2003; Horwitz, 2005). Since this paper looks at new venture the organizational tenure is of less importance because most members enter the organization at approximately the same time period. It would be more interesting to look at the diversity based on their prior work experience. The first work experience diversity measure is diversity in industry experience based on the last industry the workers worked before joining the new firm. A measure on the 3 digit NACE will be used to indicate this industry experience. The diversity in this dimension will be measured using the entropy index. The second work experience diversity variables is a coefficient of variation based on the position the individuals had in the previous firm. The disparity will be measured on the following prior job positions: CEO, top manager, middle manager, blue collar worker.

Dependent and other Control Variables

Firm survival is used as the dependent variable in this analysis. Whether or not a firm survives, and if this firm will be used for the analysis the year after, depends on a number of factors. The main argument for survival is the presence of the firm the year after. In addition to this criteria, several other criteria need to considered. Some firms are still present but they have been taken over. This will be regarded as a successful exit. The firm will be treated as a survivor, but be removed for further analysis. There are also firms that closed down but re-entered. In this analysis, re-entries will be considered as failures and there-

fore be removed from the dataset. Firm data is available until 2004, which means that firm survival can be analyzed for all years up to 2003.

I need to control for other variables then those earlier-mentioned human capital variables and that are known to influence firm survival. The usual predictors are industry, size, year, and location. Two variables are created when correcting for size. First a natural log of size and second a dummy variable, called size dummy, for whether or not there is only one individual connected to the firm. Firms consisting out of one individual are by default not diverse and there needs to be controlled for this effect. Dummy variables are created for the different industries making a distinction between: High- and medium-high tech industries, knowledge intensive high technology services, knowledge-intensive market services, and knowledge-intensive financial services. Besides the type of industry I will also, as suggested by Brüderl and Schüssler (1990), control for the type of ownership being either sole proprietorship, general partnership of a limited partnership. The last variable to control for is whether the new firm is located in the Copenhagen Metropolitan Area (CMA), since firm that are located here might face stronger competition compared to those located in other parts of the country. Such a variable has also been used in previous studies (Brüderl and Schüssler, 1990; Eriksson and Kuhn, 2006; Dahl and Reichstein, 2006).

Results

Descriptive Statistics

Table 2 presents that descriptive statistics on the survival rate for each year for each indicated start-up cohort. From year 2 and onwards the number of firms are not equal to the number of surviving firms in the year before. This can be explained by successful firm exit and the right censored data, there is no data available after 2004. The survival rate in the first year starts with 71.16 percent and increases for each year until 87.43 percent in the last year.

Table 2: Survival and Failure

year	start-up cohorts	N	survive	fail	survival rate
1	1997-2000	3956	2815	1141	71.16 %
2	1997-2000	2739	2038	701	74.41 %
3	1997-2000	1995	1631	364	81.75 %
4	1997-2000	1612	1366	246	84.74 %
5	1997-1999	852	726	126	85.21 %
6	1997-1998	421	373	48	88.60 %
7	1997	183	160	23	87.43 %

In Table 3, the means and standard errors are reported for the different variables. Some interesting changes are visible for throughout over the years. As expected, the average size of the firm increases over the 7 year period and the number of one person firms decreases

from 48 percent at founding to almost 27 percent in the last year of observation. The increase in size, especially when one person firms recruit more employees, will have a strong effect on the change in diversity. The majority of firms, around 58 percent, are located in the Copenhagen Metropolitan Area. The data shows that new start-ups in these new technology based and knowledge-intensive firms are male dominated. However, the share of women in these firm increases leading to an increase in gender diversity. As expected, the average age of the workers in the firm increases. In addition, the age diversity increases also, which means that there is an inflow of younger workers in the firms. Diversity in nationality shows low values, which is to be expected due to the dominant share of danes in the sample.

The average education level in these technology based and knowledge-intensive firms are high compared to the average of all start-ups in Denmark during the same period. Besides this observation, the data also shows an increase in the average education level. The diversity in education types increases over time. A similar trend is visible in the first four years on the diversity in education levels. The remaining two variables, i.e.diversity on industry experience and previous job position, show a strong increase in diversity over time but with a strong increase from year 1 to year 2. The strong increases in diversity can for a large part be explained by the change from one-person to multiple-person firms.

Regression Analyses

The effect of the different types of diversity on firm survival is measured using a logistic regression analysis. Table 4 shows the outcome of the analysis for each year up to the fifth yearlooking at the effect of diversity on the ascribed and the achieved characteristics.[1] The control variables show that one person firms have a significant negative effect. For year 2 and year 3 there is a positive effect of size on firm survival. In addition, the ownership of the firm has a significant impact on the likelihood of firm survival. After the correction for these normal predictors of firm survival, it appears from the results that diversity has no significant effect on the likelihood of survival. *Gender diversity* is persistently non-significant effect on the likelihood of survival. *Age diversity* is also non-significant although there appears to be a positive effect of a higher average age on the likelihood for survival. However, this effect disappears after three years. *Nationality diversity* shows many negative estimates none of these estimates are significant. So, also being diverse on this ascribed characteristic has no effect on the likelihood of firm survival.

Surprisingly,the achieved characteristics show the same non significant effects. Although the average education level seems to have some small significant positive effect on the likelihood of innovation there is no indication that *education type diversity* and *education level* are significant. However, the signs for the latter show negative estimates in the first three years. The only variable that shows a significant sign in the achieved characteristics is industry experience but only for the second year. The diversity in previous job positions

[1] I excluded the analysis for year 6 and year 7 because I encountered problems regarding the model fit

Table 3: Descriptive Statistics

Variable	year 1		year 2		year 3		year 4		year 5		year 6		year 7	
	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ
survival	0.712	0.453	0.744	0.436	0.818	0.386	0.847	0.360	0.852	0.355	0.886	0.318	0.874	0.332
size	2.152	2.505	3.232	4.754	3.814	7.304	4.197	7.143	4.330	7.585	4.245	5.134	3.878	4.091
size dummy	0.483	0.499	0.372	0.435	0.357	0.479	0.339	0.474	0.315	0.465	0.276	0.447	0.268	0.444
CMA	0.579	0.493	0.588	0.492	0.594	0.491	0.596	0.491	0.573	0.495	0.568	0.496	0.568	0.497
share men	0.733	0.368	0.733	0.343	0.735	0.335	0.722	0.335	0.700	0.338	0.708	0.322	0.704	0.331
average age	37.959	10.161	39.012	9.884	39.927	9.935	40.483	9.656	40.877	9.286	41.523	9.141	41.591	8.988
average education level	2.634	1.315	2.673	1.247	2.707	1.245	2.744	1.219	2.701	1.197	2.705	1.187	2.633	1.188
gender entropy	0.172	0.289	0.224	0.303	0.238	0.305	0.254	0.309	0.276	0.313	0.298	0.313	0.286	0.312
c.o.v. age	0.109	0.157	0.139	0.163	0.149	0.165	0.166	0.178	0.188	0.190	0.214	0.203	0.222	0.211
nationality entropy	0.019	0.083	0.032	0.103	0.034	0.107	0.034	0.103	0.035	0.103	0.044	0.117	0.035	0.104
education entropy	0.274	0.378	0.374	0.419	0.405	0.433	0.421	0.432	0.432	0.444	0.450	0.447	0.428	0.443
c.o.v. education level	0.197	0.281	0.244	0.283	0.251	0.276	0.261	0.277	0.272	0.276	0.271	0.269	0.271	0.264
industry experience entropy	0.444	0.546	0.634	0.661	0.685	0.700	0.734	0.729	0.776	0.742	0.855	0.735	0.767	0.663
c.o.v. job position	0.138	0.209	0.174	0.213	0.181	0.208	0.197	0.216	0.199	0.216	0.226	0.219	0.223	0.214
N	3,956		2,739		1,995		1,612		852		421		182	
startup cohort	1997-2000		1997-2000		1997-2000		1997-2000		1997-1999		1997-1998		1997	

shows no significant effect.

Table 4: The Effect of Diversity of both the Ascribed and the Achieved Characteristics on Firm Survival

Parameter	year 1	year 2	year 3	year 4	year 5
Intercept	0.226	0.307	0.866	1.980	-0.932
	(0.260)	*(0.320)*	*(0.442)*	*(0.551)*	*(0.773)*
ln (size)	0.231	0.412**	0.413*	0.003	0.510
	(0.199)	*(0.185)*	*(0.239)*	*(0.260)*	*(0.415)*
size dummy	-0.463***	-0.568***	-0.557**	-0.707**	-0.071
	(0.165)	*(0.192)*	*(0.261)*	*(0.316)*	*(0.437)*
CMA	-0.031	-0.029	-0.054	-0.222	0.070
	(0.076)	*(0.094)*	*(0.125)*	*(0.152)*	*(0.212)*
limited partnership	0.308***	0.392***	0.399***	0.302***	0.538**
	(0.056)	*(0.067)*	*(0.089)*	*(0.107)*	*(0.152)*
general partnership	0.509***	0.262***	0.071	0.255*	-0.011
	(0.075)	*(0.085)*	*(0.111)*	*(0.135)*	*(0.187)*
sole proprietorship	benchmark	benchmark	benchmark	benchmark	benchmark
share men	0.162	0.229*	-0.169	-0.281	-0.002
	(0.104)	*(0.139)*	*(0.199)*	*(0.234)*	*(0.296)*
average age	0.023***	0.012**	0.011***	-0.006	0.029
	(0.004)	*(0.005)*	*(0.007)*	*(0.008)*	*(0.012)*
average education level	0.070**	0.081**	0.102	0.037	0.101
	(0.029)	*(0.038)*	*(0.048)*	*(0.058)*	*(0.085)*
gender entropy	-0.146	0.220	-0.249	0.025	1.095
	(0.165)	*(0.200)*	*(0.283)*	*(0.350)*	*(0.468)*
c.o.v. age	0.227	0.444	-0.002	0.819	0.596
	(0.328)	*(0.399)*	*(0.544)*	*(0.667)*	*(0.824)*
nationality entropy	-0.435	0.179	-1.074*	-0.179	-0.187
	(0.458)	*(0.481)*	*(0.604)*	*(0.814)*	*(1.220)*
education entropy	0.127	-0.198	0.034	-0.105	-0.302
	(0.184)	*(0.208)*	*(0.276)*	*(0.340)*	*(0.459)*
c.o.v. education level	-0.237	-0.167	-0.331	0.226	-0.022
	(0.216)	*(0.261)*	*(0.360)*	*(0.443)*	*(0.588)*
industry experience entropy	-0.223	-0.442**	0.023	0.017	0.347
	(0.192)	*(0.204)*	*(0.263)*	*(0.297)*	*(0.439)*
c.o.v. job position	0.291	-0.111	0.273	-0.268	-0.351
	(0.239)	*(0.295)*	*(0.414)*	*(0.505)*	*(0.644)*
Industry dummy	yes	yes	yes	yes	yes
year dummy	yes	yes	yes	yes	yes
N	3,956	2,739	1,995	1,612	852
Log Likelihood Ratio	289.181***	134.399***	89.384***	60.948***	26.005***

Standard errors in paratheses
*** Significant at the 1% level ** Significant at the 5% level *Significant at the 10% level

Effects of Team Diversity on Firm Survival

This study on 3,956 new established firms in technology based and knowledge-intensive industries shows that diversity based on the characteristics of entrepreneurial firm members plays no significant role in explaining firm survival. Three groups of hypotheses have been formulated making a distinction between diversity on the ascribed characteristics,

the achieved characteristics and a longitudinal perspective. These are divided in smaller sub-hypotheses, which will be answered.

Hypothesis 1, which has been divided in three sub hypotheses, argues that diversity on the ascribed characteristics has no positive effect on firm survival. Hypothesis 1a, that focused specifically on diversity in gender, is supported. Gender diversity has no significant effect on the survival of these firms. The expected effect of age diversity as formulated in Hypothesis 1b is accepted. The third and last sub hypothesis focused on diversity in nationality, which according to the analyses, shows a non significant effect in the over the entire period. Hypothesis 1c is thus supported.

Hypothesis 2, which argues for a general positive effect of diversity on the achieved characteristics is totally rejected. There are no signs that a diversity on the achieved characteristics has a significant effect on the likelihood that firm survive. Although diversity on education is positive in the start the significance disappears in the following years. Hypothesis 2a would thus be rejected for year 2 to year 7. The other achieved characteristics show negative or non significant effects in the first year. Based on these findings Hypothesis 2b, 2c and 2d would be rejected. Even more so considering the non significant effect in later years. A possible explanation of the negative values for job position and education level diversity would be the link with status which would result in conflict. Hypothesis 3 can be rejected because there are hardly any significant effects of diversity on firm survival.

Conclusion

There are many studies that have focused on the effect of a diverse team composition in organizational settings. However, the number of studies focusing on diversity in entrepreneurial ventures is scarce. Because these ventures are characterized by a high degree of uncertainty and turbulence diversity plays an important role, although often treated implicitly. This study attempts to look at the diversity in these ventures and more specifically how the diversity based on the ascribed and achieved characteristics influence the effect on firm survival. There exist contradicting arguments on the expected effect of diversity because such firm need a diverse set of resources, i.e. heterogeneity, but also cohesion, which is facilitated by homogeneity. A combination of both heterogeneity and homogeneity would be expected to be the key to firm survival.

Based on tests on 3,956 newly founded firms in technology based and knowledge-intensive industries over an five year period I find no significant effect of diversity on the likelihood of firm survival. These results are somewhat surprising when compared to the existing literature. There are a number of possible explanations why this is the case and I will elaborate on a few. The first explanations is simply that diversity shows no effect on the survival of firms. This might be because (i) the measures used do not lead to the predicted conflicts or (ii) because the measure have only an effect on those measure that do not influence firm

survival on the short run, e.g. productivity and innovation. The selection process involved in entrepreneurial ventures already lead to very homogeneous composition of firms. This has been analyzed by Ruef et al. (2003) and the descriptive statistics also indicate that this is the case in this study. So, there is a high share of firms that are homogeneous on those dimensions being discussed in the paper. However, there are other dimensions of diversity, e.g. diversity in perspectives (Harrison and Sin, 2006), which are not observable in the data that influence the performance of these particular firms and leverage the shortcomings of both diverse and homogeneous teams. Another explanation might be that the effect of the diversity measures are overshadowed by other measures that influence firm survival, e.g. firm size. Finally, the industries chosen are not influences by diversity as much as other industries in the Danish economy. A previous version of this paper (Timmermans, 2009) analyzing all start-ups in the danish economy showed that diversity has an effect. The high degree of high educated individuals in this particular sample might explain the better problem solving ability when there is a lack of diversity in the achieved characteristics.

Despite the present results there is much room for further analyses. Studies on how the performance of teams is affected by diversity have been around for many years. The drawback of these analysis is the static perspective towards these team studies. Further research should focus more on a more dynamic and longitudinal perspective of diversity. New data sources similar to IDA make it possible for researchers to study these diversity effects. However, diversity can be found on many different dimensions and the most important dimensions are not necessarily the ready observable ones. Diversity in perspective require a case study approach but even on these dimensions a longitudinal and dynamic perspective would be desired. As expressed in the introduction, the focus on entrepreneurship and team dynamics would be an interesting path to take. Especially since entrepreneurship is a team effort rather than an solo exercise. This path has been followed by a few but more work lies ahead. Also in the improvements of this paper.

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